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ABSTRACT

The concern of geographers regarding use of natural resources and outdoor recreation is reflected in the vast amount of research done on this topic. Cited in this document are numerous research projects, project methodology, and conclusions related to the use of natural resources. The author concludes by stating that additional empirical research is necessary. The vantage point of the geographer is necessary but the science of geography must also utilize the strengths and insights of other disciplines for the most effective study and planning of the use of our natural resources. (DB)

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Geographic Methodology in Natural Resource and Outdoor Recreation Research

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GEOGRAPHIC METHODOLOGY IN NATURAL RESOURCE AND OUTDOOR RECREATION RESEARCH

According to The Science of Geography prepared by a committee of geographers for the National Academy of Sciences in 1965, "Geography's overriding problem which it shares with other branches of science, is that of a full understanding of the vast system on the earth's surface comprising man and the natural environment." [1] The committee stated that there are three parameters for any scientific problem--space, time, and composition of matter. The geographer's concern is obviously with space in time.

Geographers have studied space relations of the man-environment system for decades. The organizing concept of the discipline, that of "spatial distributions and space relations," is a central theme. Theoretical frameworks for the study of the man-environment system have followed from this concept. Specific examples are: Central Place Theory density thresholds, and diffusion theory, with which many rural sociologists are undoubtedly familiar. Within the last decade geographers have begun to apply vigorous analytical approaches such as multivariate techniques and systems concepts which are common to all the physical and social sciences. These approaches offer a common ground for communication between disciplines. The critical appraisal of our discipline in 1965 recognized that geography had reached a critical stage of opportunity stemming from:

> "(1) the now vital need to understand as fully as possible every aspect of man-natural environment system, including spatial distributions, throughout the world; (2) the development of a common interest among several branches of science in the overriding problem and its spatial aspects; (3) the development of a more or less common language for communication for the first time among all pertinent

> branches of science through mathematical statistics and systems analysis; (4) the development of far more powerful techniques than ever before for analyzing systems problems, including spatial distributions; (5) a backlog of spatial experience which geographers have accumulated from their spatial prospective and their past dedication to study of man-environment complex."[2]

Today, there is an increasing social need for the understanding of spatial relations which can be recognized by our society's demand for efficient space management. This need involves the integration of the geographers' experiences with that of other scientists who are concerned with the man-environment milieu. This integration has infrequently taken place in selected scientific periodicals.[3]

The geographers' interests in natural resources can be traced back a century to George P. Marsh's book entitled, Man and Nature; or, Physical Geography as Modified by Human Action.[4] From Marsh's synthesis of the literature and his descriptions of man's modification of the environment evolved a philosopny of nature and seeds for the conservation ethic. However, his pioneering work did not motivate geographers until many years later. The first geographers did not become actively involved in natural resource utilization and planning until the 1930's. During this decade geographers were actively involved in land-use mapping and land capability studies for the Tennessee Valley Authority and for the Columbia Basin Project.[5] During the years 1949 through 1951 a land classification project for Puerto Rico undertaken by geographers included an economic feasibility survey of a proposed irrigation project.[6] In the 1950's a geographer (Ackerman) directed the federal government's appraisal of water problems in ten major river basins in the United States.[7] It was also during this period of time that Thornthwaite and his associates developed the water balance and allowed for interpolated estimates of water deficit, surplus, and potential evapotranspiration from temperature and precipitation data.[8] An appreciation

of the problems associated with the hydrologic cycle was obtained from these water balance studies and practical applications, particularly to irrigation agriculture, were employed.

Geographers have often failed in their land use inventories because their findings were not always applicable to planning needs. The management decision process was not expedited by many such surveys. The regional concept asserted by geographers did not always provide management insights or alternatives as to technical changes, although there were exceptions.[9] It became obvious that inter-disciplinary outlooks and new methodologies and techniques were becoming increasingly necessary.

The most recent work by geographers, dating from 1960, appears to have much more practical resource application, i.e., economic and managerial alternatives. In general, the water resource has been the primary focus of the discipline. By far the most important contribution of these studies has been in the arena of resource-environmental perception relative to water hazards associated with the use of flood plains. Gilbert F. White and his associates at the University of Chicago pioneered in this work. White's initial work appeared in 1945. In Human Adjustments To Floods,[10] he elaborated on the physical factors relating to the adjustments of this resource hazard. This study has been followed by other studies by White, his colleagues and students, at an increasing rate. Floodplain hazards have been viewed from an economic, social, behavioral[11] and recently by attitudinal variables.[12] The methodology established has been applied to other hazards as well, for example: storm hazards along seashores,[13] drought on the Great Plains,[14] and assessment of urban snow hazard.[15]

Burton and Kates[16] have analyzed the range of resource hazards and have advanced three explanations for variations in perceptions by the users of the same resource. First, if the hazard is directly related to

the users, the perception of the natural hazard associated with the resource is strengthened. An example would be beach erosion at a cottage site. Second, the more frequent the hazard, the stronger the perception of risk; and third, the hazard perception varies with the degree of personal experience. The authors emphasize that these explanations are blurred. For example, a number of personal experiences with a hazard does not necessarily increase hazard perception; it may even decrease it.

Other non-hazard elements of the resource environment have been investigated in the last decade. For example, a study of the Navaho tribal range[17] focused on environment perception from the range managers viewpoint. It demonstrated that without taking into account the attitudes and practices of the Navaho society, one could not successfully recommend livestock reduction and other technical changes on the range. Marts and Sewell[18] elaborated on the incompatibility of two major resources, fish and power in the Northwest. Their study does not strictly fit with the perception studies, but the discussion of alternatives and neglected aspects of policies involved with this conflict clearly fall into the natural resource perspective.

The work in environmental perception has obviously raised the much larger question of the processes that are employed in exercising choices in management decisions. White has questioned our public investment criteria based upon economic efficiency, and suggests that there is a general method of analysis which may help to describe actual resource management choices.[19] His method centers on the range of choices available to resource managers. This range extends from the theoretical to the practical, and to the actual choice made. It likewise includes the identification of the elements involved in each. His concern is not to explain

why a manager reaches a decision but to describe how he makes it.

In a more recent article White[20] outlines the need for research in public attitudes concerning our environment. Such attitude studies,

> "will throw light on how decisions in truth are made, on how the professional's own preferences figure in the proposed solutions, on what he thinks the citizen prefers, on what the citizen, given a genuine choice, does prefer, and on how all of these may shift with the circumstances and experience surrounding the choice."[21]

Included in White's outline is a discussion of the methods for measuring attitudes such as content analysis, opinion polls, consumer choices, decision making models, and experimental situations.

Geographers as well as sociologists, have done considerable research in innovation diffusion. Hagerstrand's classic works[22] include research in the spatial diffusion of person to person contacts and the spread of agricultural subsidies in Sweden in order to improve pastures on small farms. His "Monte Carlo" approach simulated actual barriers to communication both in space and time. Other geographers have advanced spatial diffusion methodology beyond Hagerstrand's work.[23] The notion of mean information fields from diffusion studies are of particular importance for modeling behavior in space. For those of us involved in natural resource utilization, measures of tendency to communicate or travel over some finite distance are paramount to understanding decision process. Geographers have utilized mean information fields to construct simulation models which allow individual choices within certain probability constraints. Some examples involving resources include the diffusion of hybrid seed corn,[24] the diffusion of irrigation wells in Colorado,[25] and the disappearance of horses with the introduction of hand tractors in Japan.[26] In the last section of this paper more will be said concerning information fields or distance-decay functions relative to recreational travel behavior.

Two relatively recent approaches that combine to some extent the environment perceptual and behavioral approach with some notions of innovation diffusion, have been conducted by Gould and Wolpert.[27] Using a game-theoretical approach, Gould considers agricultural land-utilization problems in Ghana. Farmers and cattle traders are viewed as competing against unpredictable environments--wet and dry years--with dry years being expected 59 percent of the time. Their alternative cropping strategies or selected cattle drives to a variety of markets will result in varying payoffs. The utility of his game-theoretical method does not rest with an actual problem solution, but with a host of questions which are raised for further research. Wolpert was likewise concerned with the optimization of economic returns. His analysis of farming in Sweden was based upon the spatial deviations of actual farm labor productivity and the pattern that would result if all farmers behaved in a rational economic manner. Rather than a game-theoretical solution, a probalistic solution with linear programing was used to establish an ideal pattern. Deviations from this pattern were explained in terms of risk perceptions, values, and the information levels of the farmers. Spatial diffusion of information among farmers was viewed as a random occurance and simulated. In both studies, the element of risk in the decision-making process was emphasized and notions of spatial behavior were discussed.

Interest in behavior is an increasing concern of geographers. They are questioning the perception of the physical world, and are analyzing the experiences that influence perception and behavior.[28] The work of Lowenthal in aesthetic qualities of the landscape would be of interest to those who are concerned with the recreation-tourism-travel environment. His work includes a sensitive analysis of man's historic and present day

attitudes towards the landscape. He has appraised both the old world[30] and new world landscapes[31] in depth. These investigations suggest that man's ideas and images are a product of his memory, imagination and experience, and in order to alter current values and to change many landscape blights reforms in both character and behavior are required.

Outdoor Recreation Research

A few geographers have maintained an interest in the spatial aspects of recreational activities. Early interest in the space relationships of recreation phenomena appeared in the 1930's and 1940's.[32] These studies, like early water resource applications, were of an inventory, classificatory and descriptive nature.[33] In 1959, Lucas,[34] in an unpublished paper provided an excellent review and summary. More recently in 1964, Wolfe published a bibliographic review which can be profitable to all disciplines.[35]

Within the geography profession there has been a strong trend toward local and regional economic analysis which has continued for several decades.[36] Selected examples include studies of the economic impact and development of resort centers such as Gatlinburg,[37] Banff,[38] Cape Cod[39] as well as regional resort areas such as Northeast Illinois-Southwestern Wisconsin[40] and the North German Coast.[41] In addition to the economic contributions of the recreational industry many works emphasized the sequential development of the areas as well as aspects of seasonal changes in settlement. These descriptive works, with few exceptions, were lacking in statistical data on the private sector and few were based upon personal interviews. Nevertheless, some were significant contributions because of their historical viewpoint[42] or the techniques used to measure local economic contributions.[43] Due to increased demand for recreational facilities geographers have become more involved in economic feasibility studies of proposed national recreational sites.[44]

It is significant that only a few of the geographers completing dis-

sertations in the 1940's and 1950's on a recreational subject have continued research in this same vein after having completed their formal education. Deasy[45] and Harper[46] are exceptions, but this observation suggests that the spatial analysis of recreational phenomena has not been a popular research topic in the discipline. Wolfe, another exception, has maintained ongoing research in recreation from the completion of his dissertation to the present. His analysis of "Summer Cottagers in Ontario"[47] is one of the classic studies of the earlier works. Its uniqueness stems from his use of the Canadian Post Office lists of the home addresses of summer cottagers in 1941, in order to obtain origin and destinations of seasonal vacationers. This data enabled him to trace the spatial interconnectivity of a large portion of summer recreational activity in the Province. Wolfe used an Index of Recreational Land Use Intensity in order to compare the extent and direction of travel to a summer cottage by the residents of Provincial cities. Recreational travel predictions have continued to be a major focus of his research and more will be said concerning his contributions.

Unfortunately, time does not permit a discussion of the stimulating contributions in recreational research by European geographers. This review will continue with the limitation to American and Canadian geographers. It is impossible, however, to neglect the research of Germany's Walter Christaller. He has advanced the notion that: "tourism is drawn to the periphery of settlement districts..."[48] By the use of cartographic techniques indicating tourist origin-destination data in several European Countries and regions, he presents a stimulating case. His notion may very well be true for particular tourist activities and attractions, but how many of us, journeying to the Continent for the first time, would neglect a visit to Central Places as Paris, London, or Rome?

Since 1960, the limited number of geographers who have concentrated on recreation as a field of research interest has appeared to move in two major directions. These directions include the environmental perception approach and the analysis of spatial movements and interconnections of recreational travel. In both approaches there is evidence that predictive measures have been sought as aids in the public decision process.

In the previous discussion of perception a major contribution related to recreation was purposely excluded for inclusion at this point. The work of Lucas[49] is well known to those who are acquainted with wilderness research. Using the Boundary Waters Canoe Area he examined the wilderness perceptions of three different groups: managers, canoeists, and boaters. Each group had different perceptions of the following three environmental elements: 1) wilderness qualities, 2) the area considered to be wilderness, 3) and the land use accepted within wilderness. In addition to the variations between the three groups, he found perceptual variations within groups. For example, two types of wilderness use were identified--that of the paddling canoeist's seeking the core of the area, and that of the motor-boater's remaining on the periphery. A smaller, third group of motor canoeists utilized an intermediate area between the core and periphery. Thus, in terms of wilderness use, neither managers nor recreators were viewing and utilizing the resource area according to previous concepts. Lucas' findings obviously offer utility guidelines for resource management decisions.

Two very recent studies using environmental perception methods have been undertaken by Hecock on the factors influencing beach use on Cape Cod, and by Barker on water quality as an influence on the spatial selection of sites for water recreation.[50] Barker concluded that water-oriented

recreators from Toronto would continue to select nearby sites on Lake Ontario even though they were aware of a water pollution problem.

One of the first studies, not belonging within the perception framework, was done in connection with the Meramec Basin Research Project. In this study Ullman and Volk[51] described a "geographical analog" as an operational model for predicting the use of a proposed reservoir for recreation. It was a partial interaction model in that creel census data was utilized in order to estimate attendance at a proposed reservoir, and also to compare attendance figures at existing reservoirs. A regression line was fitted by inspection in order to obtain predicted annual per capita visits by distance to the various impoundments in Missouri, Illinois and Kentucky. This data was also utilized in order to estimate annual recreation benefits that would accrue to St. Louis residents from the proposed reservoir.

The notion of using a "geographic analog" as a model for exploring present and future spatial patterns of outdoor recreation was continued in the early 1960's by the Michigan Outdoor Recreation Demand Study (MORDS).[52] An interdisciplinary research group was assembled at Michigan State University by L. M. Reid and D. M. Milstein. The practical goal of this research group was to provide an improved decision framework for the Michigan Department of Conservation for overseeing the state's complex recreational resources. Three primary elements were central to the development of the model: 1) identification of the recreational system and its component parts; 2) analysis of the spatial characteristics, i.e. origins, destinations, and interconnections; and 3) behavioral analysis including preferences and participation rates and values.

This study is unique not only from its interdisciplinary approach

but also from its application of physical systems theory. J.B. Ellis, an electrical engineer, was employed to model the system analog. Basically the model was formulated as an electrical analog wherein the county origins of potential recreators (campers in this case) functioned as current sources. Camping activities in Michigan State Parks formed the only complete documentation of origin-destination information at that time. The information was obtained from 296,000 camper permits issued in 1964. The current flow of campers seeks paths (highway links) of differing resistance and distributes itself across a systems network. The model is then "grounded" at a state park by the use of a quantitative attraction index for each state park. This quantitative attraction index was based upon the assumption that campers would be "pulled" or attracted to a park according to: 1) the quality of its physical attributes; 2) the number and quality of facilities available; 3) the outdoor recreational activities that could be undertaken; and 4) the capacity of the campground. A multiple factor analysis was utilized to group these attraction components and to rate the powers of attraction.

The system procedure in the study was found to be a reliable replication of the system which was superior to the gravity or interaction model with identical inputs. The gravity model was developed independently of the MORDS study and has been compared with the systems model by Ellis and Van Doren.[53] The statewide systems model, RECSYS has been utilized by the Michigan Department of Conservation in order to replicate and predict other activity flows since the completion of the Michigan Outdoor Recreation Demand Study.

Chubb, one of the three geographers employed on the MORDS project, has improved the RECSYS model with the addition of more realistic carrying

capacity measures and the employment of synagraphic mapping techniques (SYMAP).[54] The combination of RECSYS-SYMAP techniques have been applied specifically in order to predict the future demand for recreational boating in Michigan. This method allows for demand estimations in boat-use periods at specific locations and relates demand numerically to supply opportunities. Demand and supply are expressed in the same units of measurement allowing for direct spatial comparison via computer maps of probable surplus or deficit counties in 1980.

The physical system model for recreation travel rapidly diffused to Ontario, where it was adopted for use by the Ontario Department of Highways by Ellis for Wolfe's use.[55] Ontario has, like Michigan, successfully utilized the method in order to simulate and predict various traffic flows to Provincial Parks by selected activities. Under Wolfe's direction a number of components have been successfully modified and improved.

Wolfe has maintained a prolific output of recreational research[56] with an increasing concentration on spatial interconnections and predictive techniques in order to assist decisions in the planning process. For example, a very recent publication outlined a procedure for estimating recreational traffic flows on major highways through an analysis of daily traffic profiles.[57] His research is now culminating in a use-classification of Provincial Parks. He has built upon his previous work in Ontario, for example, the regionalization of resort areas. From his analysis of an extensive park-user survey in 1966, he is of the opinion that: "the way a park is used depends more on its location with respect to cities than on its natural attributes."[58] This is a strong statement that has yet to be verified by studies in other localities. As his use-classification nears completion, employing uncomplicated indices of extremes between

selected park attributes, it is evident that his classification has valuable predictive application for travel patterns, highway facilities, activity functions and eventually the location of future Provincial Parks.

Wolfe's work exemplifies the modeling of multi-activity spatial behavior. Recent work in Ohio by Lentnek and Van Doren[59] has been focused on a single outdoor recreational activity, that of boating. Based on the premise that watercraft can be used for a variety of boating activities, an interview survey at 15 Ohio lakes provided data for a spatial analysis of activity specialized boaters. In the first phase of this project boaters with the same activity desires were found to travel similar distances and to cluster at the same lakes.

With such origin and destination data, the investigator could classify lakes according to dominate boating activities. A similarity with Wolfe's use-classification based upon activities and natural attributes is evident. Of more significance was the fact that the boaters in each of five activity groups were traveling approximately the same distances. It was concluded that trip length for boat use was related to trip purpose. Thus, a spatial structure for these recreational activities was evident in Ohio. In a second phase, concluded but unpublished, a new technique to recreation research was tested for grouping the characteristics of boating parties relative to their choices of lakes. This technique utilized the Automatic Interaction Detector program developed by Morgan and Sonquist of the University of Michigan Survey Research Center.[60] The third phase of the study included an environmental perception approach to test the perceived variation of the boater according to the quality of resources for boating.

The geographer's interest in natural resource allocation and decision problems should be evident at this point. Research in the discipline is increasingly directed to the frontiers of spatial behavior. Modeling of the complexities inherent in resource utilization, spatial interconnections and interrelationships evident in the real world are given increased attention. Additional empirical research is necessary to test existing theories and associated concepts. The vantage point of geography is necessary to all natural resource studies, but it is a two-way street, the geographer must also recognize and utilize the strengths and insights of other disciplines.

FOOTNOTES

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